

DETAILED ACTION

Election/Restrictions

1. Restriction is required under 35 U.S.C. 121 and 372.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single invention to which the claims must be restricted.

Group I, claim(s) 1-10, drawn to a method of RTM molding.

Group II, claim(s) 11-15, drawn to a method of RTM molding.

Group III, claim(s) 16-27, drawn to a method of RTM molding.

Group IV, claim(s) 28-36, drawn to a method of RTM molding.

2. The inventions listed as Groups I-IV do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

- a. Group I has a special technical feature that "a resin flow resistance of a first resin distribution medium placed on a first surface of said reinforcing fiber substrate is set lower than a resin flow resistance of a second resin distribution medium placed on a second surface of said reinforcing fiber substrate".
- b. Group II has a special technical feature that "a degasification medium comprising a gas permeation film and a gas permeable substrate is provided between said reinforcing fiber substrate and said mold".
- c. Group III has a special technical feature that "after said resin is impregnated into said reinforcing fiber substrate so as to achieve a fiber volume

content lower than a target fiber volume content of said FRP molded material, the injection of the resin is stopped, and thereafter, evacuation of resin is continued until reaching said target fiber volume content".

d. Group IV has a special technical feature that "a resin is impregnated into said reinforcing fiber material laminate by injecting a resin in a direction from an end surface of said reinforcing fiber material laminate".

1. During a telephone conversation with Daniel Christenbury on September 3, 2008 a provisional election was made without traverse to prosecute the invention of Group III, claims 16-27. Affirmation of this election must be made by applicant in replying to this Office action. Claims 1-15 and 28-36 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.
2. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 16, 17, 22, 23 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Seal (US Patent No. 5,403,537).

5. Regarding claim 16, Seal '537 teaches:

- a. a reinforcing fiber substrate is placed in a mold ("assembling fibrous reinforcements into a desired configuration on a tool body", column 8, lines 3-4)
- b. a resin injection line and an evacuation line each communicating with an inside of said mold are provided ("resin inlet tube 19", column 6, line 9, and "vacuum line 24", column 6, line 39. See also Fig. 1, items 19 and 24)
- c. a pressure in said mold is reduced by evacuation and a resin is injected into said mold and impregnated into said reinforcing fiber substrate to form an FRP molded material ("a vacuum is applied to the laminate. A resin is then introduced to the laminate therethrough having entry and exit points. The vacuum is used to transmit resin through the laminate:", column 6, lines 1-5)
- d. after said resin is impregnated into said reinforcing fiber substrate so as to achieve a fiber volume content lower than a target fiber volume content of said FRP molded material, the injection of resin is stopped, and thereafter, evacuation of resin is continued until reaching said target fiber volume content ("Excess resin is initially vented out the vacuum attachment in the center portion of the apparatus and contained in a resin trap", column 4, line 68 – column 5, lines 1-3, and "During the infiltration of laminate 14 with resin, valve 25 is open, valve 26 is closed, and valve 24 is open. After the resin has fully infiltrated laminate 14, and flow of resin into line 24 occurs, the system of flow lines, resin gate 29, fabric ply

34, and laminate 14 are complete saturated with resin. At this point, the various valves 25, 26, and 27 are manipulated (by opening, closing, or partially closing) to manage the resin content in the laminate”, column 6, lines 40-48)

6. Regarding claim 17, Seal ‘537 teaches reinforcing fiber substrate is formed as a preform (“a preform is placed into a mold”, column 3, lines 1-2). The second part of claim 3, “having a fiber volume content, which is a rate of a volume of reinforcing fibers relative to a bulk volume of said reinforcing fiber substrate, lower than said target fiber volume content”, is only a definition of a property, and it does not define a claimed range of that property.

7. Regarding claim 18, Seal ‘537 teaches after said injection of resin is stopped, at least one line of resin injection lines is changed to an evacuation line, and said evacuation of resin is continued until reaching said target fiber volume content (“During the infiltration of laminate 14 with resin, valve 25 is open, valve 26 is closed, and valve 24 is open. After the resin has fully infiltrated laminate 14, and flow of resin into line 24 occurs, the system of flow lines, resin gate 29, fabric ply 34, and laminate 14 are complete saturated with resin. At this point, the various valves 25, 26, and 27 are manipulated (by opening, closing, or partially closing) to manage the resin content in the laminate”, column 6, lines 40-48. See also Fig. 1). Note that the presence of valves 25 and 26 enable resin injection line 19 to be converted to a vacuum line connected to resin trap 23 and vacuum 21, as suggested above.

8. Regarding claim 22, the determination of fiber volume content requires a measurement of volume, of which thickness is an inherent measurement parameter.

9. Regarding claim 23, Seal '537 teaches an injection amount of resin corresponding to said fiber volume content lower than said target fiber volume content is preset, and said injection of resin is stopped at the time reaching said injection amount preset ("After the resin has fully infiltrated laminate 14, and flow of resin into line 24 occurs, the system of flow lines, resin gate 29, fabric ply 34, and laminate 14 are complete saturated with resin. At this point, the various valves 25, 26, and 27 are manipulated (by opening, closing, or partially closing) to manage the resin content in the laminate", column 6, lines 42-48). Note that managing the resin content implies predetermined process parameters including volumes of resin to be injected and evacuated. Also, the injection of excess resin leading to a fiber volume content lower than said target fiber volume content is implicit in the fact that resin flows into line 24, which is the vacuum line connected to the resin trap.

10. Regarding claim 24, Seal '537 teaches an evacuation amount for reaching said target fiber volume content is preset relative to an injection amount of resin, and said evacuation of resin is stopped at the time reaching said evacuation amount preset (After the resin has fully infiltrated laminate 14, and flow of resin into line 24 occurs, the system of flow lines, resin gate 29, fabric ply 34, and laminate 14 are complete saturated with resin. At this point, the various valves 25, 26, and 27 are manipulated (by opening, closing, or partially closing) to manage the resin content in the laminate", column 6, lines 42-48). Note that managing the resin content implies predetermined process parameters including volumes of resin to be injected and evacuated. Also, the injection of excess resin leading to a fiber volume content lower than said target fiber

volume content is implicit in the fact that resin flows into line 24, which is the vacuum line connected to the resin trap.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

13. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Seal (US Patent No. 5,403,537) as applied to claim 16 above, and further in view of Mizukami (WO 01/00392 A1).

14. Regarding claim 19, Seal '537 does not teach target fiber volume content is in a range of 55 to 65%. In analogous art of manufacturing fiber reinforced composite articles, Mizukami '392 teaches target fiber volume content is in a range of 55 to 65% ("the content of the reinforcing fibers is preferably from 15 to 80 vol%, more preferably from 20 to 70 vol%, translation p. 15, lines 21-23) for the benefit of manipulating strength properties of the molded product. It would have been obvious to one of

ordinary skill in the art at the time of the invention to combine the method of Seal '537 with the fiber volume content of Mizukami '392 for the benefit of manipulating strength properties of the molded product. Note that the range of from 15 to 80% of Mizukami '392 includes the claimed range of 55 to 65%.

15. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seal (US Patent No. 5,403,537).

16. Regarding claim 20, Seal '537 does not teach fiber volume content lower than said target fiber volume content is in a range of 45 to 60%. However, Seal '537 does teach supplying an excess amount of resin which is subsequently evacuated from the mold. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the claimed fiber volume content lower than said target fiber volume content as claimed, in order to form the conventional product as described, as such is well within the level of ordinary skill in the art for achieving a composite product as disclosed. Note that discovery of an optimum range is well within the level of ordinary skill in the art, and such ranges will not support patentability absent a showing to the contrary, as it is not inventive to discover an optimum range by routine experimentation.

See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

17. Regarding claim 21, Seal '537 does not teach fiber volume content lower than said target fiber volume content is in a range of 45 to 55%. However, Seal '537 does teach supplying an excess amount of resin which is subsequently evacuated from the mold. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the claimed fiber volume content lower than said target fiber volume

content as claimed, in order to form the conventional product as described, as such is well within the level of ordinary skill in the art for achieving a composite product as disclosed. Note that discovery of an optimum range is well within the level of ordinary skill in the art, and such ranges will not support patentability absent a showing to the contrary, as it is not inventive to discover an optimum range by routine experimentation.

See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

18. Claims 25, 26, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seal (US Patent No. 5,403,537) as applied to claim 16 above, and further in view of Kimura (JP 56127426) (English translation provided).

19. Regarding claim 25, Seal '537 does not teach at least one layer of said reinforcing fiber substrate comprises a carbon fiber layer. In analogous art of manufacturing fiber reinforced composite articles, Kimura '426 teaches at least one layer of said reinforcing fiber substrate comprises a carbon fiber layer ("the fiber reinforcing material is prepared as one type or a combination of two or more types of the following fibers selected according to the specific purpose: ...carbon fibers", translation page 4, lines 18-19) for the benefit of obtaining a high strength and lightweight product. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the method of Seal '537 with the carbon fibers of Kimura '426 for the benefit of obtaining a high strength and lightweight product.

20. Regarding claim 26, Seal '537 teaches a woven fabric ("The fibrous reinforcements which form a laminate can be plies of fabric, mat, or stitched preforms", column 4, lines 48-49), but Seal '537 does not teach carbon fiber layer is formed as a

woven fabric. In analogous art of manufacturing fiber reinforced composite articles, Kimura '426 teaches carbon fiber layer is formed as a woven fabric ("the fiber reinforcing material is prepared as one type or a combination of two or more types of the following fibers selected according to the specific purpose: ...carbon fibers...The forms of the fiber reinforcing material include mat shape, cloth shape and/or roving shape", translation page 4, lines 18-21) for the benefit of maintaining preform shape during resin injection. It would have been obvious to one or ordinary skill in the art at the time of the invention to combine the method of Seal '537 with the carbon fibers of Kimura '426 for the benefit of maintaining preform shape during resin injection.

21. Regarding claim 27, Seal '537 teaches woven fabric as shown regarding claim 26, but Seal '537 does not teach woven fabric is formed as a unidirectional woven fabric. In analogous art of manufacturing fiber reinforced composite articles, Kimura '426 teaches woven fabric is formed as a unidirectional woven fabric ("The forms of the fiber reinforcing material include mat shape, cloth shape and/or roving shape, either isotropic or anisotropic", translation page 4, lines 20-21) for the benefit of manipulating properties of the final manufactured product. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the method of Seal '537 with the unidirectional woven fabric of Kimura '426 for the benefit of manipulating properties of the final manufactured product.

Conclusion

22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US Patent No. 3,975,479 – McClean, William George.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erin Snelting whose telephone number is (571)272-7169. The examiner can normally be reached on Monday to Thursday 8:00 to 6:00 and every other Friday 8:00 to 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Angela Ortiz can be reached on (571)272-1206. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Els

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